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## LEPIDOSIRENIDS AND BDELLOSTOMIDS.

By THEODORE GILL.

## I.

In the AMERICAN NATURALIST for November, 1893, Dr. Howard Ayers has published an article "on the genera of the Dipnoi Dipneumones" which exhibits a characteristic—"lumping"—which, may sometimes be a virtue but which, in this particular instance, has been exaggerated into a decided fault.

In 1885, Dr. Ayers created much astonishment among naturalists familiar with the history of the Lepidosirenids by not only refusing to admit the generic differentiation of *Lepidosiren* and *Protopterus*, but by contending that the representatives of the two genera were even *specifically inseparable*, and that the American habitat of the type was doubtful!

In the article just cited, Dr. Ayers has given a reluctant and grudging admission to specific rank of the two types but has unqualifiedly denied their higher rank; grudgingly, because he concludes that "if they had to be named as new discoveries to-day, and could be studied together in so doing, most zoologists would include both animals in one genus, *even if they did not group them as varieties of one species*" (p. cit., p. 922).

Dr. Ayers' former article has been sufficiently answered by Baur, Schneider, and Parker, and his last article fails to invalidate their contentions. I shall only add that, after a comparison of the entire body as well as the skeleton of *Protopterus annectens* with the descriptions and figures of the corresponding parts of *Lepidosiren paradoxa*, I am convinced that no zoologist of mature experience would hesitate to rank *Lepidosiren* and *Protopterus* as *very distinct genera*.<sup>1</sup>

<sup>1</sup>Professor Ray Lankester, in "Nature" for April 12, 1894, (p. 555), has announced that he recently obtained, "by purchase from a London dealer, specimens of the Lepidosiren of the Amazon well preserved in spirit" (how many he has not told). He has illustrated peculiarities in "the limbs of *Lepidosiren paradoxa*," and we may soon expect more details from that accomplished naturalist.

## II.

In the article in the NATURALIST (p. 923), Dr. Ayers claims to "have ascertained that, taking all the *Bdellostomids* together, they form a series in which the gill variation runs between the minimum of 6 pairs and the maximum of 14 pairs, or a DIFFERENCE BETWEEN THE EXTREMES OF 8 PAIRS OF GILLS, AND YET ALL THESE INDIVIDUALS NOT ONLY BELONG TO THE SAME GENUS—THEY BELONG TO THE SAME SPECIES!" (Big type and exclamation mark are Dr. Ayers' own).

In "Biological Lectures" delivered at Woods Holl in 1893, lately published, is reproduced (pp. 125-161) a lecture by Dr. Ayers on "*Bdellostoma dombeyi* Lac.; A study from the Hopkins Marine Laboratory." Therein Dr. Ayers has urged at length the contention just cited and has categorically stated that "the number of gills of individuals from *different localities* varies from 6 on either side to 14 on either side, with the observed intermediate stages" (p. 137).

Dr. Ayers' own record of his observation (p. 140) and summary of those of his own as well as of others (p. 156) will be an all-sufficient refutation of this claim.

"In the material which [he] was able to collect at Monterey, the following proportions of the several variations prevailed:

104	individuals	had	11	gills	on	both	sides.
26	"	"	11	"	"	one	side.
				and	12	"	the other side.
208	"	had	12	"	"	both	sides.
11	"	"	12	"	"	one	side.
				and	13	"	the other side.
8	"	had	13	"	"	both	sides.

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354 total number of individmals counted."

In his summary of observations on the number of gills, he gives formulas for all observations as follows:—

"*Bdellostoma dombeyi* 6 gills.

"	"	6-7	} indicating the sides of the body upon which the respective num- bers occurs.
"	"	7-6	
"	"	7	
"	"	10	
"	"	11	
"	"	11-12	
"	"	12-11	
"	"	12	
"	"	12-13	
"	"	13-12	
"	"	13	
"	"	14"	

It will be noticed that there is a great gap from 7 to 10 which has been straddled, but for which there is not the slightest observational basis. The logical fallacy involved is too obvious to need more than pointing out.

On one hand out of 354 specimens examined by Dr. Ayers, 208 had 12 pairs of gills and 104 had 11 pairs of gills, while 26 had 11 *or* 12 on one side. Not a single one had less than 11. No specimen with a smaller number than 10 has been recorded from the Pacific Coast.

On the other hand, of many specimens obtained in New Zealand, South Africa, etc., all had 7 or 6 and none had more.

Are not these facts sufficient to prove the distinctness of the two types?

(1) There is a gap of from 7 (maximum) to 10 (minimum) at least, between the number of gills of the two types. (2) The range of variation, considerable as it is, is limited in both directions. (3) The differences in numbers are associated with differences in geographical range. Certainly, then, the two forms are specifically distinct. Are they not generically distinct?

Dr. Ayers has truly remarked (p. 152) "It seems to have become a settled belief among the large majority of zoologists of both morphological and systematic proclivities, that the number of gills found among vertebrates never rises above

eight pairs in existing forms." The deviation from this almost universal rule led me to propose the generic differentiation of "*Bdellostomids* with an increased number of branchiæ" from those "with typically 7 (sometimes 6)." Be it recalled also that the former have "the base of the tongue between the seventh or eighth pairs of gills," while the latter have "the base of the tongue between the anterior pair of gills."<sup>2</sup> The genera thus defined were named by me *Polistotrema* and *Heptatrema* (Proc. U. S. Nat. Mus., 1882, pp. 518, 520). These have been accepted by Jordan, Gilbert, the Eigenmanns, and others, and probably will continue to be. Dr. Ayers, however, has urged that "these accounts all refer to the varieties of what I shall call *Bdellostoma dombeyi*, adopting Müller's genus on account of the inapplicability of Lacépède's *Gastrobranchus*, and of the inappropriateness of Cuvier's *Heptatremes*, which could only be used for the seven-gilled form or variety" (p. 155).

*Gastrobranchus* was a generic name formed for *Myxine* alone and of course could not be perverted to a *Bdellostomid*. *Heptatrema* can be used for the group to which it was applied with perfect propriety, even though the species deviate in having often 6 branchial apertures on one or both sides. A corresponding latitude of usage is so generally recognized by modern zoologists, that a defense of such procedure is unnecessary. Even if such an extreme view prevailed, however, there is the name *Homea* of Fleming available, and this was proposed many years before *Bdellostoma*.

There are several other questions that deserve attention, but I resist the temptation to consider them now.

<sup>2</sup>"The relation of the tongue muscle to the gills is of interest, and here again we find great variability. Müller found it to lie entirely in front of the gills in the 6 and 7 gilled forms from the Cape of Good Hope, and this condition obtains in *Myxine* so far as known. In *Bdellostoma* with 10 or 11 gills, the base of this muscle may lie between the 6th and 8th pair of gills according to Putnam. In the 12 and 13 gilled forms, I have found it between the 5th, or at most, the 6th pairs of gill-sacks." (Ayers, p. cit., p. 139, 140). No observational basis has filled the great gap between the "front of the gills" and the interspace between the 5th pair!"